

I. PROJECT PLANNING (7%) – Determine scope and objectives of project, applicable regulatory or jurisdictional statutes, and evaluate research and background information.

<i>Task</i>	<i>Knowledge</i>
<i>A. SCOPE AND OBJECTIVES</i>	
T6. Define scope of engineering geologic investigation based on preliminary review of geologic data and client objectives.	<p>K5. Knowledge of building codes pertaining to earthquake design.</p> <p>K13. Knowledge of building codes pertaining to grading and seismicity requirements that affect local jurisdictions.</p> <p>K15. Knowledge of different regional fault systems and tectonic frameworks.</p> <p>K33. Knowledge of guidelines for setbacks.</p> <p>K34. Knowledge of methods to construct site access.</p> <p>K38. Knowledge of effects of historical land uses on current site condition.</p>
<i>B. REGULATORY/JURISDICTIONAL</i>	
T22. Identify regulatory permits and requirements for field exploration and project.	K42. Knowledge of effects of local requirements on engineering geologic studies and reports.
T26. Review grading plans to evaluate potential impacts from adverse geologic conditions.	<p>K47. Knowledge of effects of physical changes on ground surface depicted on grading plans.</p> <p>K51. Knowledge of environmental and safety regulations pertaining to exploration and sampling of contaminated soil and groundwater.</p> <p>K56. Knowledge of regulations for safeguarding personnel engaged in excavations, trenches and earthwork.</p>
<i>C. RESEARCH AND BACKGROUND INFORMATION</i>	
T1. Conduct areal reconnaissance to evaluate potential geologic impacts and constraints on site exploration.	<p>K60. Knowledge of field evidence of land modifications and past use.</p> <p>K65. Knowledge of geologic and geomorphic conditions depicted in topographic and geologic maps.</p> <p>K74. Knowledge of safety hazards associated with subsurface exploration.</p> <p>K83. Knowledge of sources for published and unpublished imagery and photographs.</p> <p>K87. Knowledge of sources of published and unpublished maps, reports and raw data.</p>
T10. Identify geologic conditions that could impact site development based on review of published and unpublished geologic data.	<p>K101. Knowledge of state guidelines for siting of critical facilities/structures.</p> <p>K123. Knowledge of techniques to read design information in grading plans.</p> <p>K125. Knowledge of state guidelines for evaluating seismic hazards.</p>
T30. Review site conditions and past site usage to determine presence of hazardous materials.	K134. Knowledge of geotechnical requirements for types of structures.

II. GEOLOGIC INVESTIGATION (18%) - Determine earth processes, develop investigation programs, conduct surface and subsurface investigations, and use investigative tools.

<i>Task</i>	<i>Knowledge</i>
<i>A. EARTH PROCESSES</i>	
T74. Identify geomorphic features on remote sensing images or aerial photographs that indicate areas of potential instability or fault activity.	K1. Knowledge of advantages and disadvantages of sampling and testing methods to evaluate engineering properties of earth materials. K2. Knowledge of capabilities of different geophysical exploration methods. K7. Knowledge of characteristics of joints, fractures, shears, and rock fabric. K10. Knowledge of field measurement techniques and tools to collect geologic data. K14. Knowledge of laboratory tests to evaluate hydrogeologic properties of earth materials. K18. Knowledge of measurement techniques to assess ground movement. K19. Knowledge of effects of geologic hazards on site development.
<i>B. SURFACE AND SUBSURFACE INVESTIGATION PROGRAM</i>	
T14. Identify physical and chemical laboratory tests to characterize earth materials.	K25. Knowledge of capabilities of different drilling and trenching equipment. K26. Knowledge of methods of in-situ testing of physical characteristics of earth materials. K31. Knowledge of field evidence of erosional and depositional processes. K35. Knowledge of field evidence of mass wasting processes. K40. Knowledge of field evidence of seismic shaking. K44. Knowledge of field methods to determine permeability. K49. Knowledge of fundamentals of geomorphology. K50. Knowledge of methods to develop groundwater monitoring wells. K52. Knowledge of methods to describe lithologic and pedologic properties of earth materials. K53. Knowledge of geologic characteristics and processes of erosional environments. K62. Knowledge of geomorphic and field evidence of fault rupture. K69. Knowledge of regulatory requirements for permitting, construction, and abandonment of exploratory borings and wells. K72. Knowledge of techniques to interpret aerial photographs. K75. Knowledge of sampling and testing methods to evaluate engineering and chemical properties of soil and rock. K84. Knowledge of soil pedogenesis for interpretation of subsurface conditions. K85. Knowledge of methods to assess regional seismicity, volcanics, and tectonics. K88. Knowledge of standardized soil and rock classification systems. K97. Knowledge of techniques to collect Global Positioning System survey data. K102. Knowledge of techniques to log exploratory trenches and large-diameter borings. K111. Knowledge of techniques to sample earth materials for relative and absolute age dating. K112. Knowledge of methods to interpret remote sensing data. K115. Knowledge of tests to assess performance and durability of rock and aggregate materials. K120. Knowledge of advantages and disadvantages of different methods to sample and test groundwater. K127. Knowledge of physical and chemical weathering processes. K128. Knowledge of laboratory tests to evaluate geotechnical properties of earth materials. K135. Knowledge of field methods for hydrologic testing. K136. Knowledge of geophysical exploration methods.
T18. Identify potential physical hazards related to drilling or trenching activities.	
T27. Log geology and engineering properties of earth materials in explorations.	
T31. Log soil stratigraphy in paleoseismic trenches.	
T34. Select exploration techniques to describe and evaluate site conditions.	
T35. Map geomorphology, lithology, and geologic structures from surface exposures.	
T38. Select locations and depths for subsurface exploration and mapping.	
T65. Identify age of geologic events.	

II. GEOLOGIC INVESTIGATION (18%) - Determine earth processes, develop investigation programs, conduct surface and subsurface investigations, and use investigative tools.

<i>Task</i>	<i>Knowledge</i>
<i>C. INVESTIGATIVE TOOLS</i> T3. Collect groundwater samples for water quality or geochemical analysis. T7. Collect samples of soil and rock to represent subsurface conditions. T11. Conduct hydrologic testing. T39. Measure physical and chemical properties of earth materials with in-situ tests. T42. Measure physical and chemical properties of earth materials with geophysical tests.	

III. GEOLOGIC CHARACTERIZATION AND INTERPRETATION (25%) – Characterize and interpret geologic materials, recognize geologic hazards, and develop models of geologic conditions.

<i>Task</i>	<i>Knowledge</i>
<p><i>A. MATERIAL CHARACTERIZATION AND INTERPRETATION</i></p> <p>T2. Prepare interpretive cross-sections and maps to depict surface and subsurface characteristics.</p> <p>T60. Evaluate laboratory test results to estimate engineering geologic properties of earth materials.</p> <p><i>B. HAZARD RECOGNITION</i></p> <p>T15. Identify areas of collapsible, compressive, and expansive soils.</p> <p>T23. Identify areas of subsidence.</p> <p>T65. Identify faulting and related seismic hazards including liquefaction.</p> <p>T82. Identify landslide hazards and slope instability.</p> <p>T83. Identify volcanic hazards.</p> <p>T84. Identify erosion and sedimentation.</p> <p><i>C. MODEL DEVELOPMENT</i></p> <p>T48. Evaluate geologic structure, geomorphology, geologic hazards, geologic history and genesis and hydrogeology from published, unpublished, and field geologic data.</p> <p>T50. Evaluate geophysical survey results to interpret subsurface structure, stratigraphy or groundwater conditions.</p> <p>T69. Describe distribution of primary and secondary faulting and fault related deformations.</p>	<p>K27. Knowledge of engineering properties of earth materials used in construction.</p> <p>K30. Knowledge of methods to construct isopach maps.</p> <p>K39. Knowledge of methods to construct structure and groundwater contour maps.</p> <p>K49. Knowledge of fundamentals of geomorphology pertaining to geologic hazards.</p> <p>K58. Knowledge of geometric relationship between apparent dip of geologic structures and slopes.</p> <p>K89. Knowledge of methods to construct stereonet for slope stability and discontinuity analysis.</p> <p>K98. Knowledge of methods to depict engineering geologic conditions in cross-sections.</p> <p>K107. Knowledge of methods to interpret geophysical data.</p> <p>K127. Knowledge of physical and chemical weathering processes.</p> <p>K128. Knowledge of field and laboratory tests to evaluate geotechnical properties of earth materials.</p> <p>K137. Knowledge of effects of vegetation removal on steep slopes.</p> <p>K138. Knowledge of methods to depict or present field and laboratory data for interpretation.</p> <p>K139. Knowledge of use and effects of different timber harvest methods on slope processes.</p>

IV. GEOLOGIC AND GEOMECHANICAL ANALYSIS (20%) – Analyze geologic hazards, hydrologic conditions, model geologic conditions, and determine site and material suitability.

<i>Task</i>	<i>Knowledge</i>
<p><i>A1. HAZARD ANALYSIS-SEISMIC</i></p> <p>T32. Evaluate effect of site conditions on seismic ground motion and site response.</p> <p>T46. Evaluate fault surface rupture hazard based on paleoseismic and historic evidence.</p> <p>T62. Evaluate liquefaction susceptibility of project site.</p> <p>T67. Describe type of faults, direction, and magnitude of displacement.</p> <p>T71. Estimate relative potential for future surface displacement.</p> <p><i>A2. HAZARD ANALYSIS –SLOPE STABILITY</i></p> <p>T25. Design slope monitoring systems to evaluate depth and rate of slope movement.</p> <p>T36A. Evaluate effects of bluff instability along rivers and coastlines.</p> <p>T47. Identify geologic constraints and conditions that impact mining reclamation plans.</p> <p>T49. Identify geologic constraints and conditions that impact timber harvest plans.</p> <p>T52. Evaluate geologic factors affecting gross and surficial slope stability of natural and graded slopes.</p> <p>T58. Evaluate impact of natural and artificial water recharge on slope stability.</p> <p>T66. Evaluate seismic stability of natural and graded slopes.</p> <p>T77. Identify impact of development on stability of adjacent properties.</p> <p><i>A3. HAZARD ANALYSIS –EROSION AND SEDIMENTATION</i></p> <p>T36B Evaluate effects of erosion along rivers and coastlines.</p> <p>T40. Evaluate effects of coastal erosion and sedimentation.</p> <p>T43. Evaluate effects of erosional and depositional processes on natural and graded areas.</p>	<p>K6. Knowledge of effects of corrosive water and soil on engineered structures.</p> <p>K11. Knowledge of conditions that affect groundwater flow.</p> <p>K12. Knowledge of geologic factors that affect various foundation types.</p> <p>K23. Knowledge of engineering factors that affect fill compaction and performance.</p> <p>K41. Knowledge of methods to rock slope stabilization.</p> <p>K45. Knowledge of techniques to interpreting ground movement monitoring data.</p> <p>K46. Knowledge of methods to construct cut and fill slopes.</p> <p>K49. Knowledge of fundamentals of geomorphology pertaining to geologic hazards.</p> <p>K67. Knowledge of influence of groundwater on slope stability.</p> <p>K70. Knowledge of potential for mineral alteration to affect engineered projects.</p> <p>K71. Knowledge of methods for deterministic and probabilistic seismic hazard analysis.</p> <p>K73. Knowledge of relationship between strong ground shaking and slope stability.</p> <p>K78. Knowledge of safety hazards associated with underground construction.</p> <p>K80. Knowledge of methods to analyze landslide mechanics and soil and rock slope stability.</p> <p>K81. Knowledge of techniques to mitigate impacts of gross and surficial slope instability.</p> <p>K95. Knowledge of techniques to mitigate bluff instability and erosion along rivers and coastlines.</p> <p>K103. Knowledge of methods to evaluate settlement potential.</p> <p>K117. Knowledge of volcanic activity and associated hazards.</p> <p>K118. Knowledge of techniques to mitigate impacts of active soils.</p> <p>K121. Knowledge of procedures to evaluate earthquake ground motion parameters.</p> <p>K125. Knowledge of state guidelines for evaluating seismic hazards.</p> <p>K140. Knowledge of computer-based interpretive and analytic tools.</p> <p>K141. Knowledge of statistical analysis to define mass properties of materials.</p> <p>K142. Knowledge of methods for calculating factors of safety.</p> <p>K143. Knowledge of techniques to mitigate impacts of geologic hazards and conditions on planned structures.</p>

IV. GEOLOGIC AND GEOMECHANICAL ANALYSIS (20%) – Analyze geologic hazards, hydrologic conditions, model geologic conditions, and determine site and material suitability.

<i>Task</i>	<i>Knowledge</i>
<p><i>A4. HAZARD ANALYSIS –ACTIVE SOILS/SETTLEMENT</i></p> <p>T54. Evaluate ground-movement monitoring and survey data for subsidence, settlement, and site stability.</p> <p>T64. Evaluate potential impact of subsidence on project site.</p> <p>T68. Evaluate settlement due to site development.</p> <p>T85. Evaluate settlement due to groundwater extraction.</p> <p><i>A5. HAZARD ANALYSIS –VOLCANIC</i></p> <p>T24. Evaluate potential impact of volcanic hazards on project site.</p> <p><i>A6. HAZARD ANALYSIS –OTHER</i></p> <p>T75. Estimate degree of risk associated with surface and subsurface conditions.</p> <p>T86. Evaluate surface and underground openings, e.g., mining, tunnels, pipelines.</p> <p><i>B. HYDROLOGIC</i></p> <p>T4. Analyze groundwater piezometric data to estimate gradient and flow direction.</p> <p>T8. Analyze hydrogeologic data to estimate aquifer characteristics.</p> <p>T16. Construct flow nets for seepage analysis.</p> <p>T76. Identify groundwater recharge and discharge areas from maps, imagery, and historic records for protection and management of groundwater resources.</p> <p><i>C. SITE AND MATERIALS SUITABILITY</i></p> <p>T28. Estimate rippability of rock materials to determine excavation methods.</p> <p>T70. Evaluate soil and rock conditions related to tunneling.</p> <p>T72. Identify earth materials for use as construction materials.</p>	

V. DESIGN (15%) – Develop specifications for earth structures, drainage, grading, surface processes, and mitigate various geologic conditions.

<i>Task</i>	<i>Associated Knowledge</i>
<p><i>A. EARTH STRUCTURES</i></p> <p>T87. Provide design recommendations for earth structures.</p> <p><i>B. DRAINAGE</i></p> <p>T13. Design grouting programs for seepage control.</p> <p>T17. Design slope stabilization dewatering systems.</p> <p><i>C. GRADING</i></p> <p>T5. Design excavations for remedial grading.</p> <p>T41. Evaluate quantity and quality of earth materials used in construction.</p> <p>T44. Evaluate remedial grading excavations.</p> <p>T88. Provide cut and fill design recommendations.</p> <p><i>D. MITIGATION</i></p> <p>T21. Design remedial action plan for contaminated soil and groundwater.</p> <p>T33. Develop temporary and permanent erosion and sedimentation control plan.</p> <p>T51. Identify needs for mitigating temporary and permanent slope instability.</p> <p>T73. Establish setback distances from hazardous conditions.</p> <p>T90. Design groundwater monitoring systems to evaluate seepage, permeability, seasonal fluctuation, construction dewatering, and groundwater quality.</p>	<p>K4. Knowledge of applications for different geotextiles and geofabrics.</p> <p>K8. Knowledge of different methods and procedures for grouting programs.</p> <p>K16. Knowledge of grading and excavation techniques.</p> <p>K24. Knowledge of methods and materials for soil reinforcement.</p> <p>K28. Knowledge of methods for construction and slope dewatering.</p> <p>K32. Knowledge of methods for in-place ground improvement.</p> <p>K33. Knowledge of effect of local guidelines on setbacks for structures near active faults.</p> <p>K41. Knowledge of methods of rock slope stabilization.</p> <p>K46. Knowledge of methods to construct cut and fill slopes.</p> <p>K55. Knowledge of methods to mitigate impact of compressible soils.</p> <p>K59. Knowledge of methods to mitigate impact of corrosive soils.</p> <p>K61. Knowledge of methods to mitigate impact of organic soils.</p> <p>K63. Knowledge of techniques for retaining wall construction.</p> <p>K81. Knowledge of techniques to mitigate impacts of static and dynamic slope instability.</p> <p>K90. Knowledge of techniques to mitigate impacts of liquefaction.</p> <p>K91. Knowledge of techniques to design effluent disposal and water infiltration systems.</p> <p>K94. Knowledge of methods to control groundwater levels, flow and seepage.</p> <p>K99. Knowledge of techniques to mitigate impacts of land subsidence due to development.</p> <p>K104. Knowledge of techniques to mitigate impacts of coastal erosion, bluff instability, sedimentation along rivers and coastlines.</p> <p>K108. Knowledge of techniques to protect developments from impacts of seiche.</p> <p>K109. Knowledge of techniques to mitigate impacts of collapsible soils.</p> <p>K113. Knowledge of techniques to mitigate impacts of dispersive soils.</p> <p>K118. Knowledge of techniques to mitigate impacts of expansive soils.</p> <p>K122. Knowledge of techniques to mitigate impacts of secondary seismic hazards.</p> <p>K124. Knowledge of effects of rock properties on excavation methods.</p> <p>K144. Knowledge of soil mechanics in stability, settlement, consolidation and bearing capacity.</p> <p>K145. Knowledge of rock mechanics in rock slope instability mitigation design and foundation design.</p> <p>K146. Knowledge of blasting methods for rock excavation.</p> <p>K147. Knowledge of techniques to mitigate sediment delivery from vegetation removal on steep slopes.</p>

VI. PREPARATION AND REVIEW OF REPORTS, DESIGN PLANS AND SPECIFICATIONS (5%) - Evaluate grading and development plans for adverse conditions and conformance to geologic recommendations.

<i>Task</i>	<i>Knowledge</i>
T59. Review reports, plans and specifications to evaluate conformance with geologic recommendations. T89. Prepare engineering geologic reports, plans and specifications.	K43. Knowledge of methods to depict engineering geologic conditions on maps. K48. Knowledge of methods to describe geologic structures. K77. Knowledge of state guidelines for preparing engineering geologic studies and reports. K129. Knowledge of standard professional guidelines for graphical and written presentation of engineering geologic information.

VII. CONSTRUCTION AND POST-CONSTRUCTION MONITORING (5%) – Evaluate conformance to design specifications and report as-built/as-graded conditions.

<i>Task</i>	<i>Knowledge</i>
T37. Evaluate field data from grouting programs to verify permeability reduction.	K12. Knowledge of geologic factors that affect various foundation types.
T55. Observe geologic conditions during grading and construction to assess conformance to expected conditions.	K16. Knowledge of grading and excavation techniques.
T57. Prepare as-built geologic report to document actual geologic conditions encountered during construction.	K23. Knowledge of engineering factors that affect fill compaction and performance.
T61. Supervise grouting program for soil and rock strength improvement and permeability reduction.	K27. Knowledge of engineering properties of earth materials used in construction.
	K28. Knowledge of methods for construction and slope dewatering.
	K45. Knowledge of techniques for interpreting ground movement monitoring data.
	K46. Knowledge of methods to construct cut and fill slopes.
	K67. Knowledge of influence of groundwater on slope stability.
	K86. Knowledge of techniques to address unforeseen geologic conditions during construction.
	K94. Knowledge of method to mitigate bluff instability and erosion along rivers and coastlines.
	K99. Knowledge of techniques to mitigate impacts of land subsidence due to development.
	K103. Knowledge of methods to evaluate settlement potential.
	K124. Knowledge of effect of soil and rock properties on excavation methods.
	K148. Knowledge of vibration, air blast and noise monitoring for construction activities.
	K149. Knowledge of preconstruction surveys.

VIII. PROFESSIONAL RESPONSIBILITIES (5%) - Recognize professional responsibilities specified in state statutes and regulations.

<i>Task</i>	<i>Knowledge</i>
T79. Determine types of professional work that require the engineering geologist stamp. T80. Determine professional responsibilities regarding engineering geologic applications and types of projects. T81. Determine types of activities that constitute unprofessional conduct.	K130. Knowledge of state guidelines regarding use of the engineering geologist stamp. K131. Knowledge of state regulations regarding the engineering geologist specialty. K132. Knowledge of state regulations regarding the consequences of unprofessional conduct. K133. Knowledge of state regulations regarding consumer recourse for unprofessional conduct. K150. Knowledge of professional responsibilities and liabilities of engineering geologists.